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SPECIFICATION FOR THERMOGRAPH, BIMETALLIC

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard
SPECIFICATION FOR THERMOGRAPH, BIMETALLIC

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Indian Standard
SPECIFICATION FOR THERMOGRAPH, BIMETALLIC

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 4 September 1970, after the draft finalized by the Meteorological Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Liquid-in-glass thermometers exposed in louvred screens are generally used for the measurement of air temperature but permanent records of air temperature at meteorological and other observing stations are made with thermographs. The instrument is exposed at meteorological stations in special louvred screens to obtain temperature data representative of the area.

0.3 Specifications for thermographs in use at meteorological stations in the country have been prepared by the India Meteorological Department, but no Indian Standard specifications for these exist. With the increasing manufacture of these instruments in the country, the formulation of an Indian Standard for thermographs and their certification by ISI has become necessary.

0.4 This standard has been prepared in the interest of standardization of thermographs in use in the country and of accuracy in the measurement of temperature. The testing of all thermographs made in the country and their initial certification after manufacture will in future be the sole responsibility of ISI.

0.5 In the formulation of this standard, due consideration has been given to the requirements laid down by the World Meteorological Organization, Geneva, in addition to the special circumstances obtaining in this country.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard specifies the requirements for bimetallic thermograph. The scale value of the instrument is such that temperatures to an accuracy of 0·2°C may be read on a suitable chart.

2. DESCRIPTION

2.1 The instrument consists of a temperature sensitive bimetallic element, in the form of a flat strip or helix, connected by a system of magnifying linkage to a recording pen moving on a chart which is fixed on a drum driven by clockwork. The movement of the recording pen is controlled by changes in the bimetallic element, one end of which is rigidly fixed to the frame of the instrument. Provision is there for setting the zero of the instrument and for changing the scale value of the instrument by adjusting either the length of the bimetallic element which is used to operate the pen or the relative lengths of the levers of the linkage system. The complete recording mechanism is mounted on a base and has a hinged cover provided with a viewing window.

3. MATERIAL

3.1 The material used for the fabrication of the base and cover shall be either a light and durable metal or any other material having the following properties:

a) Rigidity and strength with no distortion or other deterioration when exposed to widely varying climatic conditions, while at the same time being light in weight;

b) Freedom from attack by animal, insect or fungoid life;

c) Smooth and permanent surface finish; and

d) Low coefficient of thermal expansion so as to minimize alterations of the frame due to temperature changes.

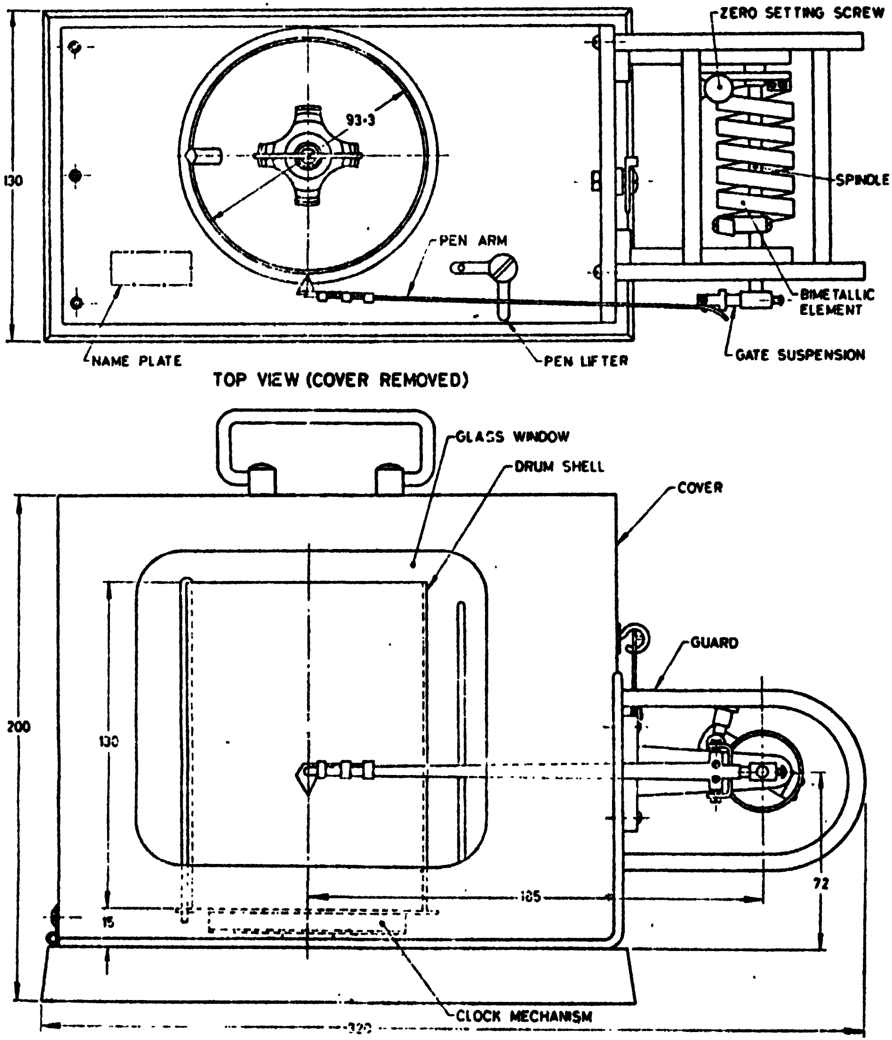
3.1.1 While any material satisfying the above requirements may be used, aluminium or glass reinforced polyester is considered as a suitable material for moulding the base and cover.

3.2 The material used for the remaining components of the instrument shall be brass, aluminium or similar material. The material used shall be such that it is capable of being finished to the specified dimensions and is not affected by exposure to widely varying climatic conditions especially at coastal stations.

4. DIMENSIONS

4.1 The general arrangement and main dimensions of the thermograph shall be as indicated in Fig. 1.

4.1.1 Though a bimetallic helix is indicated in Fig. 1, it is not obligatory to have the sensor in this form. Any shape or form is acceptable provided the performance of the instrument conforms to all the requirements of this specification.



All dimensions in millimetres.

FIG. 1 GENERAL ARRANGEMENT AND DIMENSIONS OF BIMETALLIC THERMOGRAPH

4.1.2 The design of the arrangement for zero adjustment and scale value alteration is left to the manufacturer who may also suitably alter the system of linkages to suit his design.

5. GENERAL REQUIREMENTS

5.1 Bimetallic Element Assembly

5.1.1 The bimetallic element shall be in the form of a strip or helix of suitable length and thickness so that the full range on the chart is covered. The bimetallic strips used shall be well aged (repeated heating and cooling of the strips over the entire measuring range is recommended) to counteract any tendency for a decrease in its sensitivity with time.

5.1.2 The spindles shall be made of stainless steel or similar non-rusting material and shall be perfectly straight and well polished. They shall be held in suitable bearings so that they rotate smoothly and freely with minimum friction.

5.1.3 The sensing element shall either be mounted within the instrument or be outside it; in the latter case, it shall be suitably protected by a guard or other similar device.

5.1.4 A fine adjustment screw shall be incorporated in the instrument to enable the zero position of the pen to be adjusted with a precision of 0·1°C on the chart.

5.2 Pen Arm Assembly

5.2.1 The pen arm shall be made of hard-drawn German silver sheet or similar material. If necessary, it may be ribbed in the centre for rigidity and strength.

5.2.2 The length of the pen arm with the pen shall be exactly 185 mm so that the pen follows the time grid arcs on the chart.

5.2.3 The pen arm shall be mounted in such a way that there is no play of the arm in the suspension. Provision shall be made for adjusting the angle of contact as well as the pressure of the pen on the chart.

5.2.4 The movement of the pen up and down the chart shall be parallel to the time grid marked on the chart.

5.2.5 When finally assembled the movement of the pen on the chart shall have minimum friction so that the pen returns to its original position when disturbed manually up or down through a distance equal to one small division on the chart. The instrument shall pass this test at all positions of the pen on the chart.

5.3 Cover and Base

5.3.1 The cover shall be provided with a cut-away window to enable the record on the chart to be seen without opening the cover. The window shall be covered with a transparent sheet of glass or acrylic plastic which may be slid in grooves framing the window and fixed in position. Alternatively, the cover shall be such as to provide a panoramic view of the inside. In either case the cover shall be attached to the base with a strong rustproof hinge.

5.3.2 A suitable rustproof locking device shall be provided to enable the cover to be locked to the base.

5.3.3 A suitable handle shall be fixed securely on the top of the cover.

5.4 Recording Mechanism

5.4.1 The recording mechanism shall be such that the movement of the pen on the chart is linear in the temperature range of − 20°C to + 60°C. The pen shall travel a vertical distance of 110 mm for a difference of temperature of 40°C in the temperature range of − 20°C to + 60°C.

5.4.2 The recording mechanism shall be free enough to denote clearly on the chart a change in temperature of the order of 0·2°C.

5.4.3 The friction in the instrument shall be kept to the minimum so that the record obtained on the chart is continuous without steps, that is, when there is a gradual change in temperature, the record does not show abrupt changes of temperature with traces showing periods of constant temperature interposed in between.

5.4.4 The recording pen shall have the dimensions as given in Fig. 2 and shall yield a clear trace on the chart at all times.

5.4.5 The instrument shall be provided with a clock mechanism and drum conforming to IS : 5924-1970*.

5.4.6 The chart (*see* IS : 5947-1970†) shall be ' daily ' or ' weekly ' for use with either daily or weekly clock mechanism and drum.

6. WORKMANSHIP AND FINISH

6.1 The external surfaces of the thermograph shall have a smooth and permanent finish.

6.2 The instrument shall be painted in any light colour, but light blue is preferred.

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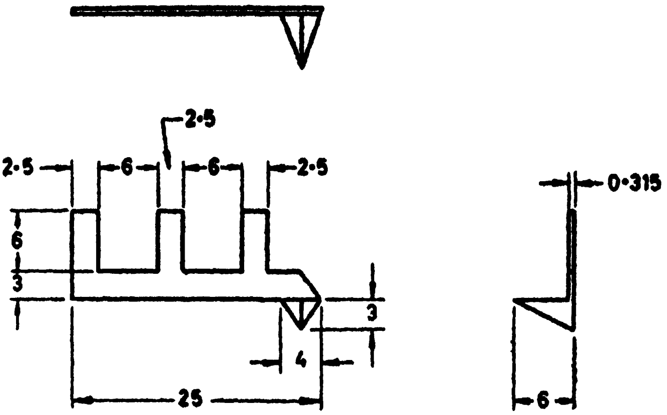
*Specification for clock mechanisms and drums for meteorological instruments.

†Specification for charts for recording meteorological instruments.



All dimensions in millimetres.

FIG. 2 DIMENSIONS FOR RECORDING PEN

6.3 The bimetallic element shall be suitably protected from rusting and other deterioration in all types of climate, particularly at coastal stations. It shall not be painted.

6.4 All metal parts shall be suitably treated so as to protect them from rusting and other deterioration, particularly at coastal stations.

7. TEST AND CALIBRATION

7.1 The thermograph, when tested in a properly designed and operated thermostatic chamber, shall indicate the change in temperature correct to within ±1°C throughout its working temperature range of − 20°C to + 60°C. This test shall be carried out with the aid of a suitable laboratory reference thermometer.

7.2 The scale error of the instrument is generally determined by immersing the sensing element successively in comparison baths kept well stirred and maintained at three or more different temperatures, the difference between lowest and highest temperature being about 40°C. The true temperatures of the water baths are obtained from a laboratory reference thermometer kept close to the bimetallic senser. The range of temperature shown by the thermometer and the instrument shall agree within the limits stipulated in **7.1**.

8. MARKING

8.1 Each thermograph shall have the following information engraved legibly and neatly on a name plate which shall be cemented firmly on the base of the instrument:

a) Name of the instrument — 'Bimetallic thermograph';
b) Word 'Daily' or 'Weekly' corresponding to the clock mechanism;
c) Designation of the chart to be used with the instrument;
d) Manufacturer's name or recognized trade-mark; and
e) Serial number and year of manufacture, for example, No. 123/1970.

8.1.1 The thermograph may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

9. PACKING

9.1 Each thermograph, without the clock mechanism and drum, shall be wrapped in dust-proof paper and placed in a corrugated cardboard carton with suitable cushioning, after lightly tying the pen arm to the pen lifter to prevent movement of the pen arm during transit. The clock mechanism and drum shall be carefully packed separately in another cardboard carton to avoid any risk of damage or deformation during transit. Both the cartons shall then be packed in a strong wooden box using suitable packing material. Alternatively, the instrument shall be packed as agreed to between the supplier and the purchaser.

10. TESTING AND INSPECTION

10.1 Each thermograph shall be tested individually for conformity to all the requirements of this specification.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 0·101 972 kgf
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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AMENDMENT NO. 1 MAY 1994
TO
IS 5901:1970 SPECIFICATION FOR THERMOGRAPH BIMETALLIC

(*Page* 3, *clause* 3.1, *line* 2) — Add 'aluminium alloy' between the words 'metal' and 'or'.

(*Page* 3, *clause* 3.1.1, *line* 2) — Substitute 'aluminium alloy' *for* 'aluminium'.

(*Page* 3, *clause* 3.2) — Substitute the following for the existing :

'The material used for the remaining components of the instrument shall be non-magnetic, non-corrosive and non-rusting material like stainless steel, brass or similar material with suitable anticorrosive paint. The material used shall be such that it is capable of being finished to the specified dimensions and is not affected by exposure to widely varying climatic conditions both at inland and coastal stations.'

(*Page* 6, *clause* 5.4.4) — Add the following at the end of the clause:

'Suitable fibre tipped disposable pen can also be used.'

(*Page* 6, *clause* 5.4.5) — Substitute 'IS 5924 :1988 (first revision)' *for* 'IS 5924:1970'.

(LM 21)

Reprography Unit, BIS, New Delhi, India